

by Corda) of the spirals renders it necessary to view these appendages also in another light; in fact, this character seems to connect *Myxotrichum* with *Helicosporium* and similar genera, where the filaments bear strings of sporidia coiled up into spirals, and at the same time to show, as indicated in fig. 4. Pl. VI., the intimate connexion subsisting between the ordinary spores of the Hyphomycetes, whether arranged in chains or occurring singly, and the bodies termed *conidia*.

Hitherto our information concerning the position of this fungus has been but scanty. In the 'Micrographic Dictionary' of Griffith and Henfrey (ed. 2, p. 483), the genus *Myxotrichum*, to which our present species was referred by Kunze, is thus noticed:—"A genus of Dematei, growing on rotten wood, paper, &c. Three species are described as British—*M. casium*, Fr., *M. chartarum*, Kze., and *M. deflexum*, Berk. They form little tufts or downy balls, sending off radiating branched filaments. The spores are described as occurring collected in masses about the base of the threads (?)." In Mr. Berkeley's 'British Fungology' (p. 353), the genus *Myxotrichum* is referred to the Mucedines, and its characters given as follows:—"Flocci branched, bearing towards their base little conglomerate masses of spores." Corda placed his genus *Actinospira* among the Sporotrichaceæ, describing it thus:—

"ACTINOSPIRA. Flocci ramosi, continui, cornei; sporis simplicibus, basi in glomerulos coloratos heterogeneos conglutinatis.

"*A. chartarum*, Corda, tom. vi. tab. 2. fig. 23. Acervulis subglobosis; sporis ooidis aureis."

Mr. Berkeley, to whom I am indebted for my information as to the history of the present plant, tells me that it is supposed to be a condition of some *Chaetomium*. I hope my observations and the figure given may aid in determining its true relations.

Mr. Berkeley's *Ascotricha chartarum** presents, in the appearance of the thallus and conidia†, a slight approach to the character of the young plants of *Myxotrichum* figured in my drawing; but the genera to which the plants belong are, so far as present observations go, quite distinct.

IX.—*Observations on a Species of Pycnogon* (*Phoxichilidium coccineum*, Johnston), with an attempt to explain the Order of its Development. By GEORGE HODGE.

[Plates IV. & V.]

THE generation and development of the Pycnogonoidea, to the best of my knowledge, have hitherto received a very small share

* Ann. Nat. Hist. ser. 1. vol. i. pl. 7, p. 257. † *Ib.* pl. 7. fig. 8 d.

of attention. Many naturalists, during their investigations, must have noticed and recorded certain facts bearing upon these points; but it unfortunately happens that these have either remained unpublished, or are inaccessible to the ordinary student, who is therefore left to grope in the dark, and to rely upon his own observations and research for any knowledge of this interesting subject that he may be desirous of obtaining. Little has been said of the anatomical differences of the sexes; we only know that most, if not all, of the females of the several species possess an additional pair of members, anterior to the ordinary feet. These members, known by the name of 'false feet,' differ in different genera, have been made an important aid in classification, and are furnished with a number of setæ, of forms varying according to the genus or, it may be, species; and near to these setæ, at certain periods, the eggs or ova are found.

We know nothing of the earliest stage, or means by which the ova are produced and fertilized; and, so far as I am aware, the subject has not been alluded to by any writer on these animals. The only published record to which I have had access is a paper by Kröyer in the 'Annales des Sciences Naturelles' for 1842, being "Notes on the Metamorphosis of the Pycnogonides," wherein the larval forms, as attached to the females of *Pycnogonum littorale*, *Nymphon grossipes*, and *Phoxichilidium femoratum*, are figured and described. I have also been kindly favoured by Mr. Spence Bate with some MS. notes "On the Morphology in the Development of the Pycnogonidæ," which were read at the British Association Meeting of 1855. These authors, however, go no further than the larval forms, and make no allusion to the subsequent stages through which the young animals pass before they attain the mature state; therefore the following observations, although imperfect in some most important particulars, may perhaps be the means of guiding others in the search, and thus ultimately lead to the complete elucidation of the development of the Pycnogonoidea.

The species that afforded me material for the following observations, and which I believe to be *Phoxichilidium coccineum* (Johnston)*, may frequently be taken at low-water mark, crawl-

* *Orithyia coccinea*, Johnston. "Animal araneiform, slender, of a uniform fine clear red colour, with the joints of the legs and tarsi yellowish, and, when magnified, a central vessel, distinguished by its deeper tint, is seen running uninterruptedly through the body and legs: rostrum yellowish, porrect, cylindrical, somewhat thickened outwards, divided beneath by a mesial line shorter than the mandibles, which originate from the anterior margin of the first segment, and are biarticulate; the basal joint long, while the second forms a short ovate hand armed with two subequal curved claws: body 4-jointed, the first with an oculiferous tubercle; the eyes obscure: legs four pairs, with a few widely scattered short hairs;

ing or, rather, sprawling over Algæ and Zoophytes, more frequently the latter. In most instances I have met with them on a muddy bottom, probably because the Zoophytes on which they seem to feed are found there. During a careful and systematic series of "rock-hunts," undertaken with the view of obtaining a collection of the smaller and rarer marine animals of this part of our coast [Seaham], I collected a handful of a species of *Coryne* (*C. eximia*, Allman) from a small rock-pool, under the shelter of the overhanging side of which depended a most interesting fringe of Zoophytes, such as *Coryne*, *Tubularia*, *Plumularia*, &c. The *Coryne* was very abundant; and many of the polyparies attained the unusual length of 3-4 inches, and were, at the period when taken (August), profusely covered with Medusoids in various stages of growth. As I collected these specimens, I noticed some peculiar dark brownish-red pear-shaped sacs scattered over the stems, more especially on the lower portions. Concluding they were some peculiar organisms connected with the growth of the *Coryne*, they did not receive more than a passing glance; but on arriving at home, the specimens were turned out into dishes, and by accident a hand-lens was applied to one of the dark-red sacs, when it was seen that the red colour depended principally upon a central portion, resembling in an extraordinary degree a small Pycnogon with very short legs. The sac was then ripped up; and the imbedded object, being extracted and gently freed from the investing mucus, proved to be a veritable young Pycnogon. Here was a discovery—a Crustacean (?) within a Zoophyte! Puzzled and surprised, I endeavoured to ascertain more of the extraordinary partnership (the benefit all on one side, I am inclined to think) that appeared to exist between the *Coryne* and the Pycnogon.

three times the length of the body, equal, 8-jointed; the basal joint short; the second somewhat longer than the third; the fourth slightly dilated, elongate; fifth and sixth slenderer, but as long; seventh minute; eighth rather long, falciform, spinous on its inferior edge, and terminated by a single rather long claw. [There are two claws: one is very small, and is rather difficult to see, from its position; it issues from the base of the larger, near to its insertion into the falciform joint, and clings closely to the larger claw.—G. H.] Length of the body 2 lines, of the legs 6 lines. With a common magnifier, the body appears very smooth; but when a more powerful glass is used, it and the legs are seen to be roughish with minute granules." ("An Attempt to ascertain the British Pycnogonidæ," by Geo. Johnston, M.D., in 'Magazine of Zoology and Botany,' vol. i.)

Phoxichilidium coccineum, Milne-Edwards, 'Crust.' vol. iii. p. 536, 1840 (Goodsir, in 'Annals and Magazine of Natural History,' vol. xiv. 1844).

Nymphon femoratum (Rathke, Nat. Hist. Skrifter, vol. i. p. 201).

Phoxichilidium femoratum, Kröyer, in 'Annales des Sciences Naturelles' for 1842. In speaking of this species, he says, "I believe this animal identical with the *Orithyia coccinea* from the coasts of England."

The natural inference on first finding these sacs would be that they had been attached by the mature Pycnogon—in fact, were the germs cemented to the polypary, and that the difference in form (pear-shaped, instead of globular as when attached to the false feet of the female) might be the result of growth. On submitting, however, the sacs to microscopical examination, their external appearance so closely resembled the growth of *Coryne*, and, on the other hand, was so totally different from anything that could be imagined to be the product of a Pycnogon, that little doubt remained on my mind that the sacs were really the result of some peculiarly directed growth of this zoophyte. To ascertain, therefore, how far the cavity of the sac communicated with the central portion or cœnosarc of the *Coryne*, a sac was cut transversely, near to its connexion with the supporting stem; and a gentle pressure being applied, the nutrient matter of the *Coryne* escaped from the wound, just as would be seen if a stem was so cut. Transparent specimens were next examined, and the result left no doubt of the sacs being part and parcel of the *Coryne*. All question upon the matter was, however, completely set at rest by my finding that these sacs had been already noticed by Prof. Allman, who, in a communication made to the British Association in 1859, arrived at a precisely similar conclusion with respect to their zoophytic origin. The abstract of his paper, being very short, may be here quoted entire.

“On a remarkable form of Parasitism among the Pycnogonidæ.

“By Professor ALLMAN, M.D., F.R.S.

“The author described the occurrence, on the branches of some species of *Coryne*, of peculiar pyriform vesicles, which might at first sight be easily taken for the reproductive sacs of the Zoophyte. They had their cavity in free communication with the general cœnosarc of the Zoophyte; and an endoderm, ectoderm, and external chitinous investment were easily demonstrable in their walls. The nature of their contents, however, at once distinguished them from the proper reproductive sacs of the *Coryne*; for in every instance they enclosed a Pycnogonidan (*Annothea?*). The enclosed Pycnogonidan was always solitary, and in the smaller vesicles was still embryonic, while in the larger ones it presented an advanced stage of development, and was ready to escape from its confinement by the rupture of the surrounding walls.”

Now come the questions:—How is the sac formed, and how does the young Pycnogon get into the sac? These problems are more difficult to solve than would at first appear; yet it may, I think, be proved that at any rate the sacs are merely modified growths of the Zoophyte.

If figs. 6, 7, 8, & 9, Pl. IV. are examined, it will be seen that

the sacs present a strong likeness to "stunted branches" of the polypary, as if a shoot had been suddenly brought to an abrupt termination by an enlargement consequent upon its occupation by a young Pycnogon. This view of the case becomes more evident if we examine the annulated character of the sac, which will be found to agree closely with the same parts seen in the polype, which are similarly annulated. It would therefore appear as if the young Pycnogon occupied the place of the ordinary polype in the Coryne. The sacs are usually found on the lower portions of the stems branching out from the sides, as shown at fig. 6, though occasionally they were met with much higher up. The only manner in which I can account for their position on the lower portions of the stems is this: the young Pycnogons, judging from their growth and the circumstances under which they are found, must have gained access to their tenements at an early period of the year, when the Coryne was but small; and the higher branches would seem to be growths subsequent to the period at which larval forms abound, which have risen above the level of the parasitically infested shoots.

I possess a female *Phoxichilidium*, taken during the present year, at Lerwick, by the Rev. A. M. Norman, which has several germs or ova seated on the false feet: from an examination of this specimen I was so fortunate as to obtain a clear insight into some of the very early stages of the ova, which, so far as I can judge, throw much light upon the subsequent stages.

Each sac or germ contains a large number of minute ova, which are attached to the investing membrane by four filamentous appendages. These ova, in early stages, are globular (see fig. 1), and appear to consist of a number of granules enclosed in a transparent envelope, from whence proceed the filaments just alluded to. As these granules increase in size, they undergo a sort of segmentation, and put out six rounded lobes, four being at the precise spots from which the filaments are produced, while the remaining pair are larger, appearing between the two pairs, and rapidly increase into two prominent processes, which soon assume the form of foot-jaws (see figs. 2 & 3), and are each provided with a pair of "nippers." The first four warts, two and two, continue their growth, increasing in length very considerably, and ultimately produce four legs, which, though unjointed, are capable of considerable movement. From the tips of these legs the long filaments are seen to proceed; and these have also considerably increased in dimensions, especially at their junction with the legs. Meanwhile the foot-jaws have also considerably enlarged, and by their outward growth have given place to another lobe or wart between them, which shortly assumes the form of a rostrum. And now we see a little Pyc-

nogon (fig. 4), with only four legs, it is true, but those members are of surprising length, and serve the purpose, I apprehend, of attaching the several larvæ to each other and to the sac containing them.

Having, therefore, seen the form and apparent principle of development of the ova from a mere mass of granules up to a period not far from that at which they would burst their bonds and enter upon a different life, we now come to the most difficult question—How does the young Pycnogon gain access to the Coryne? For the actual indisputable answer to this I am afraid we must patiently wait; at present, we can but surmise and guess at the process. I may perhaps be allowed to record my opinion; right or wrong, future results must settle. We have seen that the young Pycnogon, at the most mature stage at which I have observed it attached to the female, possesses a rostrum, a well-developed pair of foot-jaws (being in fact the most perfectly organized portion of the animal at this stage), and four rudimentary legs, terminated by very long filaments, which attach the young animal in an indirect way to the female. From the appearance of the outer membrane investing the little animal, and the rudimentary character of the legs, I expect a moult would shortly take place, and the animal would then entirely free itself from the investing skin and legs, with their attached filaments, being then of a globular form, with a pair of foot-jaws and a short rostrum. At this stage of the development the little animals become free, and here we lose all trace of them as connected with the adult Pycnogon; we should naturally expect that there was little chance of ever again falling in with them in their young state, in consequence of their minute size at this period ($\frac{1}{800}$ to $\frac{1}{400}$ inch across); and doubtless many observers have lost them at this stage. I imagine they are carried by the waves into pools, similar to that before alluded to, and containing a quantity of Coryne. The young animal would naturally cling to any fixed support, and, it may be, progress in some peculiar manner, and thus reach the polypes, or else the tentacles reach it, and shortly afterwards it is conveyed to the oral orifice of the Zoophyte, and being engulfed, is again lost to us, as, once in the Coryne, it becomes the food of that animal, and we cannot doubt that it possesses some means of digesting and assimilating such particles of matter, vegetable or animal, as may serve as nutriment. The young Pycnogon, having been received into the cœnosarc of the Zoophyte, must necessarily undergo the process of digestion and consequent dissolution: but in this particular case we find the ordinary rule does not hold; for the young Pycnogon is found whole and undergoing development within the polypary: if it has passed in by the

oral orifice, it has by some peculiar means escaped the common fate of most small animals that the polype gets hold of; and if it did not pass in by this aperture, how did it get in? I can see no other means of entrance; and when we remember that in many cases peculiar forms of animal life are found in the intestines and other parts of various animals of higher grades than those at present under consideration, to which they could only have gained access by the mouth of the animal they infest, and must therefore have been subjected to the process of digestion in their passage to those parts where they are found, it does not appear so very extraordinary that a parallel case exists amongst low forms of marine life. There is no other view of the case that I can conceive at all tenable. The polypary, from consisting of a strong horny envelope, would utterly defy the attacks of a puny animal like that under consideration, assuming, for the sake of argument, that the young animal desired admittance through the polypary, and endeavoured, in its humble way, to gain an entrance by means of its foot-jaws: such a view will, I think, be admitted as utterly unlikely. So far then as I can see, in the absence of a better, we must at present content ourselves with the opinion before expressed.

The young Pycnogon being now within the Coryne, we will endeavour to trace the future stages. The little animal, once within the cœnosarc, doubtless makes the most of its foot-jaws, and commences a search for a suitable "locale." To the instinct or other directing agency by which it is guided in this search, I am not prepared to allude: it is sufficient if we take it for granted that it does move freely along the tube of the polypary; whether by accident or instinct, it matters not. A glance into the circumstances of the growth of the Coryne may assist us in understanding the fact of the Pycnogon being found in a sac, without doubt produced by this Zoophyte.

The Coryne, at the time the larval forms may be expected to gain an entrance, from being of humble growth, as before mentioned, would not possess many polypes; numbers would, however, be in course of production. So far as I know, the growth of these polypes results from a branch springing from a stem, at first short and rounded at the free end; the rounded portion, however, changes its character from a thin investing membrane (or membranes) into a "fleshy head" or polype, at first rudimentary, but capable of producing its several parts. During the period that these short rounded branches exist, and before they have begun to assume the polype-character, a young Pycnogon enters one of them, having made a journey from the polype by which it entered, along the cœnosarc tube of the Coryne; arrived at the end, there it remains to mature, and, by

a wonderful provision, the development of the terminal portion of the polypary into a polype is stayed (Pl. V. figs. 7 & 8), doubtless by the young Pycnogon availing itself of the nutrient matter circulating within the coenosarc as food, and thus withdrawing the material that should have developed a polype. The outer envelope or portion of the polypary (at this particular part) gradually enlarges, so as to assume the form and appearance before described, and the Pycnogon being comfortably housed amidst an abundant supply of food, nothing but time is requisite to enable it to undergo the necessary development.

With such an abundant supply of food as must necessarily be presented to the young parasite within the Coryne, its growth must be rapid. At Pl. IV. fig. 10, I have represented one of the animals extracted from the sac. At this stage its size is much greater than the minute form before described: it now measures $\frac{1}{8}$ inch across. An inspection of the figure will convey a pretty accurate idea of the appearance of the animal. It will be seen that the foot-jaws still retain their advanced state of development, as compared with the other portions, and the rostrum is still short and rudimentary. The foot-jaws were very active, opening and shutting in a highly excited manner, which was perhaps not to be wondered at when we consider the unceremonious way in which it was again introduced into the world. Within the rostrum, near its base, a peculiar pulsating movement is seen; further than this, no motion is discernible.

The larva must have moulted, and got rid of the four rudimentary legs and their filamentous appendages; *for we here see that the young Pycnogon is destitute of legs (not a trace remains), and that the previously described process of the production of these organs by the gradual formation of lobes, to be subsequently elongated into legs, is again seen*: there are now seven such lobes, three at each side and one opposite the rostrum, the latter showing a faint indication of division. The eyes, near the base of the rostrum, are also in course of formation; but at this period they are merely seen as a patch of colour.

Passing onward to a further growth, we come to that stage when the young Pycnogon is found in the sac, with the legs doubled up, as shown at Pl. V. fig. 14. The several organs have now attained a considerable degree of development, and bear a close resemblance to the mature form. Fig. 15 represents the last joints of a leg, with the strong bristles in course of formation. At this stage there is an indication of the young Pycnogon being within a supplementary skin, external to the true skin: this appearance is best seen in the last joints of the legs. The growth of the terminal claw seems a work of time, the deposition of hard material being irregular and unequal.

Having traced, with some slight interruptions, the germs to the larvæ, the larvæ to the immature and parasitical young, we now come to the concluding stages, viz. that period at which the young animal, well developed and furnished with the necessary organs to enable it to provide for itself, seeks an exit from the Coryne-sac or vesicle: here the foot-jaws doubtless play a most important part.

Such sacs as contain well-developed animals are found to be deeply tinged with colour near the summit: if these are selected and kept in clean and cool sea-water, the whole process may be watched. The animal evidently uses its foot-jaws to rupture the investing skin of the sac, which at this stage, from some peculiar circumstance, seems more limp and pliable than at other times. An opening having been effected, one or both of the claws of the first feet are projected through the opening, and, with the usual slow and languid movements of the class, are worked about, doubtless widening the breach; then another leg appears, and another, until the whole animal emerges and sprawls away. If we examine the figure of the free animal as seen shortly after its escape from the sac, it will be noticed that, although closely resembling the mature form in those features that guide us in the discrimination of the species, it nevertheless requires further development. It still has only six legs, the fourth pair being represented by short rounded lobes; these lobes, gradually growing, become jointed, and are furnished with claws and bristles; after which the animal merely requires time to mature its several parts. Whether this is gradual, or assisted by a further moult, I am not prepared to state: it has been seen to perform this process in early life; so it is not improbable that it may do the same in a more advanced stage*.

Finally, I figure a male *Phoxichilidium coccineum*, and also a portion of a female, both fully matured; so that the several stages, from the germs, devoid of organs of any kind, to the perfect animal, may be compared, and their several points of difference and gradual growth be fully understood.

Setting aside for a short space all that has been written on the subject of the anatomy of these animals as bearing upon their

* Since writing the above, I have been so fortunate as to discover the moulted skin of the young *Phoxichilidium* which is cast by the animal before or at the time of leaving the sac of the Coryne: this cast-off membrane is extremely delicate and transparent, and shows the several limbs, &c., from which the animal had withdrawn itself, apparently without much damage to the exuvie. It therefore seems highly probable that the increase of growth in these animals is effected in a similar manner to that of other Crustacea, viz. by a series of moultings. We have seen two instances of this during the embryonic stages, and there is no reason why the process should not continue in after-life.

true position, especially by Quatrefages*, I think, if anything were wanting to show their connexion with the Crustacea, the mere phases in their development would be sufficient to decide the matter, and convince those who wish to remove them from this class of their error.

The teachings of development must ever exercise a powerful voice in classification; and when we see so many instances of the degradation of some animals and elevation of others, in consequence of the increase of our knowledge in this direction, we must all allow that, until we are fully conversant with the life-history of an animal, no matter how profound our other acquaintance with it may be, we have still much to learn. Nearly every animal that we can name possesses some wonderful story which requires unfolding as to its early life; and as our knowledge in this direction is extended, we trace step by step the connexion of one form with another, and prove that forms now regarded by zoologists as fully matured, and therefore described as so many distinct species, are but the varied phases assumed by some one animal during the singular stages of its development. Hence the value of the study of development—that great law of life, everywhere seen and everywhere at work, silent but sure, teeming with beauty, and elevating all who rightly ponder and study the manifold mercies and wisdom of the great Creator who has made so many and such varied forms of life—varied in form, varied in habit, and varied in usefulness, but all showing a marvellous beauty of design and adaptation of form and habits to the several circumstances of their lives.

In conclusion, I have to express my thanks to my esteemed friend the Rev. A. M. Norman for the valuable advice and assistance he has so kindly afforded me during my investigations and in the preparation of this paper.

EXPLANATION OF PLATES.

PLATE IV.

- Fig. 1.* Early appearance of larva of *Phozichilidium coccineum*, removed from ovum attached to female.
- Figs. 2 & 3.* Further stages, showing the early appearance of foot-jaws and rudimentary legs.
- Fig. 4.* Well-developed larval stage, with foot-jaws, rudimentary legs, and their filamentous appendages.
- Fig. 5.* The same, more highly magnified, and showing more distinctly the several parts.
- Fig. 6.* Branch of *Coryne eximia*, with sacs of various forms, and in several of the positions they occupy upon the polypary.
- Fig. 7.* Branch of *C. eximia*, with a sac at the extremity of a stem, and a young polype in course of formation at the extremity of another stem.

* See Quatrefages in 'Annales des Sciences Naturelles.'

Fig. 8. Branch of *C. eximia*, with a sac at the extremity of a stem, which by its position appears to have withdrawn the nutriment from an adjoining part, staying the growth of a shoot, which is seen as a short rounded lobe.

Fig. 9. Branch of *C. eximia*, with a sac at the extremity of a stem.

Fig. 10. Early form of parasitical young, at that period of its existence when it has moulted for the first time and got rid of the rudimentary legs and their appendages, *being now entirely destitute of legs.*

Fig. 11. Further stage, or that period at which it is found free, having effected its escape from the sac.

PLATE V.

Figs. 12 & 13. Portions of females, mature and immature, showing the form and growth of the false feet or "egg-carriers."

Fig. 14. Parasitical young in an advanced stage, and as found doubled up in the sac.

Figs. 15, 16, & 17. Various stages in the development of the claws: viz., 15, whilst within the sac; 16, shortly after escape; and 17, when mature.

Fig. 18. Mature male *Phoxichilidium coccineum*.

X.—*Contributions to British Carcinology.* By the Rev. ALFRED MERLE NORMAN, M.A.

II. *On Species of Ostracoda new to Great Britain.*

Fam. Cypridæ.

Subfam. I. CYPRINÆ (Dana).

Genus CYPRIS (Müller).

Cypris punctillata, n. sp. Pl. II. figs. 11–14.

Forma subovalis; altitudo maxima ante medium sita; margo dorsalis valde arcuatus, ventralis in medio incurvatus. *Forma desuper spectata* ovata, in medio latissima, extremitates versus eodem modo parum attenuata. *Latitudo altitudoque* fere æquales. *Basis* lata, ad extremitates convexa, trans medium impressa atque concava. *Valvarum superficies* undique pilis obsita, cellulisque rotundatis numerosissimis excavata. *Margo valvarum interior* antice et postice latus, lamellosus; lamella sulco profundo excavata; antice et postice aculeis fimbriatus. *Color* saturate viridis. Long. $\frac{7}{80}$ unc.; alt. $\frac{4}{80}$ unc.

Habitat stagna limpida prope Sedgfield in regione Dunelmensi.

Carapace subobovate; dorsal margin boldly arched; ventral margin incurved centrally; the highest part of the valves situated a little before the middle. Surface everywhere clothed with long hairs, and sculptured with closely arranged roundish cells. The superior portion of the anterior extremity is margined with a row of eight spines; and the inferior portion of the posterior extremity in the right valve is margined with about five spines. The lowest of these posterior spines is considerably